higher class of labour, and such men can, if desired, be recruited through labour colonies, distress committees, labour bureaux, or charitable agencies. There is, then, no need to accept inefficient labour with the object of affording occupation to the unemployed. The labour employed in the national forests should not fall below the ordinary standards, and should be remunerated at the ordinary rate of the district for similar labour. Subject to the requisite standard of efficiency being attained, preference should be given to those temporarily or permanently unemployed in the district, especially where evidence of such efficiency can be furnished by public or private agencies for the reclamation and training of the unemployed class.

(17) To establish afforestation on commercial lines does not, however, preclude its being used as an instrument of social regeneration. A broad view of economics cannot exclude from its cognisance the grave national charge which unemployment with all its concomitant results involves, to say nothing of the personal deterioration by which it is often accompanied. Sylviculture is not unsuitable for building up the moral and physical fibre of even the most depressed of the unemployed classes, and its agency may well be invoked for this purpose, and advantage taken of its healthy and wholesome influences, provided that any additional expense incurred by the employment of less efficient labour be defrayed from a separate account.

(18) In estimating the amount of employment furnished by afforestation, it is well to distinguish between the temporary labour involved in the creation of the forest and the permanent labour needed for its maintenance. Taking varying circumstances into consideration, it may be said that, on the average, it will take twelve men to afforest 100 acres in the planting season of four to five months, and that every 100 acres afforested will provide permanent employment for at least one man. If 150,000 acres be annually taken in hand, the labour of 18,000 men will be needed, and permanent employment will in due course be afforded to 1500 men, rising by an additional 1500 every year until the end of the rotation. The number permanently employed would then approach 100,000. The labour absorbed by felling and converting timber, to say nothing of subsidiary industries which spring up around a timber supply, has been considered too remote to warrant detailed estimation, but there is undoubtedly a large field of employment in this connection. It is important to remember that, on the basis of 1,000,000*l.* being annually spent on the operations of afforestation, apart from the cost of the land, employment would be afforded, directly and indirectly, to many more than 18,000 men. Indeed, the number employed may be roughly taken to be represented by about double that figure. For the incidental occupations, such as building, the making of implements, the provision of materials, &c., all involve the employment of additional labour.

(19) A special advantage of forestry in relation to labour is that it offers a new source of employment. The labour connected with timber and timber products imported into the country is performed abroad, and thousands of families are maintained on the produce of the labour associated with the timber industry. Another advantage bound up with the extension of sylviculture is that the market for its produce is so great that it is inconceivable that it could seriously interfere with the output from private woodlands, and no difficulty of competition between the State and individuals need be apprehended.

(20) The acquisition of grazing areas, private or common, for sylviculture might necessitate a modification of the existing agricultural system on certain farms. It is unreasonable to suppose that the remaining lowland areas on such farms could not, in many cases, either be adapted to other forms of agriculture or be profitably utilised for small holdings. Further, the conversion of comparatively unprofitable lands into forests enhances the productiveness of the adjacent areas, and should materially assist the small holdings movement. It has also the advantage of furnishing winter employment to small holders.

SCIENCE MASTERS IN CONFERENCE.

THE Association of Public School Science Masters held its ninth annual meeting at the Merchant Taylors' School on January 12, under the presidency of Sir Clifford Allbutt, K.C.B., F.R.S., who delivered an address entitled "The Function of Science in Education."

"If," he said, "our fathers looked out from a darker world upon a narrower dawn, it was upon an intenser light and a nearer vision than ours. We know better where we are, it is true; we can see more—we certainly run after more; but are we pressing as keenly forward on the line of promise? We are cutting and paving the road better for the throng upon the route; but the engineer who maps and makes the road may be too busy to regard the forerunners who, heedless of moss and rock, are crying to the multitude to cast aside every weight and race forwards to the light. Still, both prophet and engineer are needful to us, and it is a straight and business-like inquiry for men of science to ask themselves how far they are engineers, how far prophets.

"The home and the school should develop the service of the child, the imagination of the child, his intellect, and his ethics. Morals cannot yet be explained to him scientifically; the help of science to ethics will be recognised later. If scientific training does not generate the passion for righteousness, by its ordinances these aspirations are directed and fortified. Until the conceptions of modern science had permeated us, we had no full sense of the unity of society nor of our duty to our neighbour. As now the survival of the fittest has become an emulation, not of individuals, but of social groups, it is the most coherent groups which will govern the earth. In science may be discovered the sanctions of simplicity, sincerity, and brotherhood to chasten a luxurious age, such as in former times literature alone, even an Augustan literature, failed to regenerate.

"What do we mean by science? We do not contemplate experimental science only, we include the pristine idea of all orderly knowledge, of analysis of concepts for the construction of systems of affirmative propositions. There is no branch of education, or of the business of life for which it is to fit us, which science is not busily re-handling, re-modelling, and re-interpreting. This is not to say that the methods you and I represent are to become sole masters of mankind. Action may be sicklied o'er by too much thought, by too much analysis, and herein is engendered that distrust—reasonable and unreasonable—which the humanist has always felt of the man of science. The humanist winces to see the flower of literature stiffened into a diagram. My point of view demands the pursuit of what is called 'classical' culture, not as in itself education, but as a constituent of education.

"The British boy, generically speaking, is a very matter-of-fact little person; very serious, very curious, and very handy. It is from his great example *man* that he may learn flippancy, satiety, mental inertia. In our educational methods do we foster the precious seriousness of the boy? Do we feed his curiosity, or do we snub and disgust it, so that when he leaves school all or much of his natural ardour for knowledge is blighted? All schoolmasters must learn, what the science-master can teach them, that, if by his own hands the boy can contrive no great art, yet it is immediately by promoting the activity and precision of his nervomuscular system that nature is building up, not his practical brain only, but also much of the hive of his mind—not to mention the congruities of bodily sanity. The boy will tolerate drudgery if his seriousness is not fatigued, and if his eyes are lifted continually over the dry intermediate task to realise what he is to see at the end of the hard high road. He must be led, not only to do the right things, but also to enjoy them. (By the way, is there a public-school playing-field in England which has been accurately surveyed and mapped by the boys?) The boy's curiosity might be better cherished by a more comprehensive literary outlook. By the new history, the new archæology, the new geography, the 'classics' are indeed becoming more of a living subject; we are bold enough to claim that it is by science that these changes have been wrought, and that, with-

out leaving other studies undone, natural science taught by masters who retain the keen curiosity of the boy, who are still as serious as the boy, and who can beat him in handiness and research, is an integral part of education. It is eminently fitted to cherish his seriousness, to develop his curiosity into research, and to multiply his formative dexterities.

"I admit a little bias against abstract science for boys. Some mathematics must enter into the curriculum; but my impression is that most schoolboys are almost as incapable of abstraction as terriers. Some older boys can get no inconsiderable grip on universals; but it is a topsy-turvy education which begins with universals and ends with a few particulars. For most boys natural history and mechanics may prove more congenial than chemistry.

"Science is not a hobby, nor even a modern system of utilitarian ingenuity; it is a way of observing and interpreting everything, including religion. In later life, most of us have to concentrate upon specific studies or crafts; but while I plead for even more differentiation for the various boy than at present he has, I protest that to box off 'science' artificially on a 'modern' or any other 'side' is to perpetuate an unnatural schism. An education which is not modern is an anachronism. I do not desire to see headmasters more specifically scientific than linguistic; but he who is to mould a school should inspire it as a whole, and be in full and understanding sympathy with every part and function of it. If he only knows so much of science as to misunderstand it, or just to tolerate it, the educational mill will continue to throw out, to the right and to the left, batches of half-educated men."

Mr. L. Cumming, in moving a vote of thanks, took the opportunity to point out that their boys had to pass examinations, and that examiners set questions on "abstract science." Dr. Garnett, in seconding the vote, directed attention to the fact that some boys can learn from reading, some from tactile perceptions. We should be ready to gain access to the mental citadel by the particular gate which happened to be open. In his reply, the president said that there will be a great saving of time when the scientific spirit gets possession of the school and compels coordination in teaching. The universities were partly to blame for the perpetuation of the segregation of schoolboys into classical, modern, and other sides, as their prizes are on the side of Greek and Latin.

Mr. M. D. Hill gave an account of the anthropometric work which has been carried on for fifteen months at Eton. Anthropometry includes psychological and physiological characters as well as morphological, tracing correlations between characters while examining the effect of environment. Psychologists, ethnologists, and statesmen require data which must be obtained from anthropometry. Already the examination of 500,000 children in Scotland as to colour of hair and eyes has solved problems of race-migration. Their work at Eton was connected with medical inspection. Instructions for practical work could be found in the report of the committee of Section H of the British Association, 1908. Mr. Gray, as secretary to this committee, expressed the hope that public schools would take up the inquiry so as to make it national in scope. We want an audit of national physique. Mr. Earl (Tonbridge) had found the value of such observations from the schoolmaster's point of view, as they make possible the detection of defects, and in his experience remedial treatment has resulted in the improvement of the physical tone and alertness of boys.

In the afternoon there was a discussion on the British Association report on the sequence of science studies in boys' schools. Mr. G. F. Daniell introduced the subject, saying that the inquiry had shown the existence of general agreement as to the subjects to be taught and as to their sequence, but that great diversity of opinion and practice exists in regard to methods. This diversity was approved; the teacher's liberty should be preserved and the influence of external examinations restricted. Mr. W. D. Eggar (Eton) spoke of the growth of geography as a school subject. This quite desirable growth had made the subject too wide for one teacher; he advocated putting physiography into the science course, and leaving commercial and historical aspects to be dealt with by other than "science" masters. Mr. R. G. Durrant (Marlborough) read a paper on teaching the nature of solution in schools, and advocated the introduction of the ionic theory as soon as the boys had some idea of atoms and molecules. Mr. G. H. Martin (Bradford) gave an account of his science course for boys on the *classical* side. He had found most successful results from geology, and he concluded that the only form of science suitable to such boys was one which, besides being of immediate application, furnishes the basis of an after-school hobby and permanently enlarges the mental outlook. A discussion followed, in which Sir Clifford Allbutt, Prof. Armstrong and others took part. A resolution protesting against the refusal of the General Medical Council to "recognise" public schools in their regulations for the registration of medical students was passed on the motion of Mr. C. I. Gardiner.

As in former years, the exhibition of apparatus formed an important and instructive feature of the meeting. Twenty-four members contributed useful and novel pieces of apparatus, often of much ingenuity, and occasionally of delightful simplicity. Several well-known firms of apparatus dealers and publishers sent displays which filled the great hall, and the whole display could not be exhausted in the four and a half hours allotted to its examination. We note a few of the objects of interest.

Dr. T. J. Baker showed a safe method of liberating hydrogen from water by action of potassium. A layer of naphtha is poured on the water, and a fragment of potassium is thrown in. The form of Hore's apparatus exhibited by Mr. D. J. P. Berridge derived interest from the fact that it was designed by a boy at Malvern. Mr. Berridge's still and water-bath (made by Fletcher, Russell and Co.) is of a serviceable pattern for school laboratories. Several teachers will thank Mr. Cooke for his method of burning magnesium in steam by plunging an ignited helix into a flask where water boils briskly. Mr. Cross exhibited "components" for building up "simple machines" and compounding them; being well made, they should have much educational utility. Electrical instruments such as can be built in school workshops—perhaps the best way of teaching electricity to many boys—were shown by Mr. L. Cumming. Quite a large and varied set of exhibits was contributed by Mr. Garbutt, including a nearly fool-proof apparatus for showing the volume composition of hydrogen chloride, and an ordinary Bunsen burner converted into a rose burner by drilling holes near the top of the tube and putting a small flat asbestos circle or dish on the top. Most of us have experienced trouble from burettes with broken taps; Mr. Hedley showed us how to repair them with ebonite taps, shaped by any carpenter. Mr. Martin's laboratory illustrations of geological phenomena helped to enforce the arguments of his paper. Mr. Ryley's evaporating crucible and Mr. Talbot's lantern are already well known. We liked Mr. Leyland Wilson's improved shelf for ovens, and his method of purifying sulphuretted hydrogen deserves trial. He passes the impure gas over calcium hydrate and moist sawdust, which absorb the sulphuretted hydrogen only. The latter can be liberated at any desired rate whenever required by passing a current of carbon dioxide over the calcium sulphydrate.

Among the trade exhibits we may mention the galvanometers and curved mirrors by Messrs. Philip Harris and Co., who have just issued an excellent catalogue. Messrs. Becker have attained the acme of simplicity in their burette stand, made in teak, at half-a-crown. We saw some useful clamps for chemical and optical apparatus at the stand of Messrs. Collins. Messrs. Reynolds and Branson have fitted a thoroughly satisfactory microscope attachment to the Stroud-Rendell lantern, and a blow-fly proboscis was shown with good definition and illumination. It is a pity that so few science-masters employ the lantern microscope for class purposes. Good design and accurate finish characterised the instruments for teaching mechanics which Mr. G. Cussons had on view. Experienced workers would not like to be without his "tripod and capstan" stands and clamps. We were reminded that we live in an age of luxury when we looked at Messrs. Griffin's electric furnaces; but the same firm caters for those who, from choice or necessity, seek to reduce expenditure on

apparatus. Their school microscope, with objective eye-piece, rack focussing stand with firm foot, is priced at 35s. We welcomed old and tried friends in the Becker's Sons' balances, and a new one in the Dobbs's dynamometer, which appeared among Messrs. Townson and Mercer's display. Mr. Thomas Wyatt exhibited the appropriately named Massey series of apparatus for practical mechanics, and some Haldane Gee instruments of better construction than those on the market in former days. The stills and ovens of Messrs. Brown and Son are well known to chemists; they should be well known to science masters.

We have not space to describe the extensive exhibit of books by Messrs. Arnold, G. Bell, Clive, Macmillan, Methuen, and the Cambridge and Oxford University Press.

Some of the amateur exhibitors were at too little pains to show their work effectively, and we would remind them of the necessity of making clear at once, by diagram or otherwise, the main point of their exhibits. If a plan of the exhibits could be added to the catalogue it would be helpful. The trade exhibits are of undoubted utility, especially to country workers, but it is to be hoped that the invaluable display of resourcefulness and ingenuity springing from our school laboratories will not be relegated to a subordinate position. The thanks of all who had the good fortune to see this successful exhibition are due to the hon. secretaries, Mr. D. J. P. Berridge and Mr. G. H. Martin, for their skilled cataloguing and organisation.

The president of the association next year will be Prof. H. E. Armstrong, F.R.S., who has given the society much help since its foundation. G. F. DANIELL.

VARIOUS INVERTEBRATES.[1]

THE fourth volume of zoological reports on the *Discovery* collections is full of interest and fine workmanship. It well deserves its beautiful "get-up." Dr. H. F. Nierstrasz describes the single Solenogaster in the collection—naming it rather awkwardly *Proneomenia discoveryi*, sp. n., and takes a survey of the family Proneomeniidæ. Prof. G. H. Carpenter gives an account of a remarkable collembolon—*Gomphiocephalus hodgsoni*, g. et sp. n.—apparently an ancient connecting link between Poduridæ and Entomobryidæ. In contrast to these two cases of sparse material, we find Mr. W. M. Tattersall reporting on more than ten thousand schizopods, mostly referable, however, to one species. He and Mr. Holt have been able to add ten to the previous list of seven South Polar schizopods, and the present memoir as some interesting results as regards life-history and dist. bution. The collection includes no species of schizopod common to both polar regions, but all the genera save one, Antarctomysis, are represented in northern waters. The northern species are quite distinct from their southern allies.

Similarly Dr. R. N. Wolfenden notes that the Antarctic copepod fauna is distinct from that of Arctic seas, and that the species which are typical of the Antarctic and most numerous do not extend far into the southern Atlantic at least. The *Discovery*, like the *Gauss*, was fortunate in finding the interesting crinoid Promachocrinus, which was one of the prizes of the voyage of the *Challenger*. Prof. F. Jeffrey Bell deals with this re-discovered treasure, and with a number of interesting new forms; he also directs attention to the "bewildering" variability of several species, *e.g. Cycethra verrucosa*. His memoir has numerous illustrations of a certain dry humour, as when he notes that "even the most recent writers on echinoderms have not yet promulgated the doctrine that difference in size is a specific character, though I am not quite sure that in practice they do not sometimes act as though they had." It has been supposed that none of the Antarctic echinoderms has free-swimming larvæ, but Prof. E. W. MacBride and Mr. J. C. Simpson describe the plutei of a sea-urchin and an ophiuroid. They also found an unsuspected brood-pouch in *Cucumaria crocea*, a well-known holothurian.

Bell's *Antedon adriani* yielded two species of Myzostomum, which Dr. Rudolf Ritter von Stummer-Traunfels deals with. One is new, *M. antarcticum*, illustrating the common experience that every new species means another new species—of parasite; the other, *M. cysticolum*, has been previously recorded from Ross's Sea in the Antarctic, from off the east coast of Japan, and from the tropical West Atlantic—a remarkable distribution which finds its explanation in the antiquity of the myzostomid group and in the uniformity of deep-water conditions. The sipunculids are represented by some thirty specimens. These Mr. W. F. Lanchester describes under the title *Phascolosoma socius*, n. sp., and in so doing makes some interesting critical remarks on the relative value of the systematic specific characters in this group. Two new sea-anemones are described by Mr. J. A. Clubb, but the most interesting part of his report is the description of the sixteen "brood-pouches" of *Cribrina octoradiata* (Carlgren) from the Falkland Islands. Each pouch arises as an invagination of the three layers of the body-wall, retains its external pore, and usually contains two embryos. In reporting on the tetractinellid and monaxonellid sponges, Mr. R. Kirkpatrick describes twenty-two new species of the latter, and establishes four genera. Some of the records of Antarctic distribution are striking, *e.g.* that of *Esperiopsis villosa*, Carter, a form frequently recorded from high northern latitudes, but only from one intermediate station, viz. in deep water off the Azores; or that of *Sphaerotylus capitatus* (Vosmaer), an Arctic form, not reported from any intermediate locality—as yet. There are no fewer than nineteen plates illustrating this memoir, and there are twelve illustrating Mr. T. F. Jenkin's admirable account of the Calcarea, which teems with novelties, two new families, six new genera, and new species galore. Altogether, it cannot be doubted that the *Discovery* was true to her name.

[1] National Antarctic Expedition, 1901–4. Natural History. Vol. iv., Zoology. Pp. 280; 59 plates. (Printed by Order of the Trustees of the British Museum, 1908.)

THE DANISH NORTH-EAST GREENLAND EXPEDITION.

THE account of the Danish North-east Greenland Expedition, given by Lieut. A. Trolle before the Royal Geographical Society on December 7, 1908, is printed in the January number of the society's journal, with several instructive illustrations and a map. During this expedition, which lasted two years, the little-known fjords and coast of north-east Greenland were explored, and much other valuable scientific work was accomplished, though the tragic death of the leader, Mylius Erichsen, and his two companions, Hagen and Brönlund, while on a sledge expedition, gives melancholy interest to it. In his lecture Lieut. Trolle only referred in general terms to the results of the scientific work carried on by the various observers during the expedition, as these will be published later, but the subjoined extracts from the paper, and the two illustrations here reproduced by permission of the Royal Geographical Society, will show that the expedition was marked by notable achievements.

The object of the expedition was to explore the last of the hitherto unexplored parts of Greenland. The whole of the west coast from 78° N. lat. to Cape Farewell is, as is well known, under the administration of Denmark. On the east coast there is a Danish colony at Angmasalik, while great parts of the coast had been mapped by Captains Holm, Garde, Ryder, and Amdrup. The stretch from 72° to 77° N. lat. had been explored, chiefly by Clavering and Sabine, by the *Germania* Expedition, by the English whaler Scoresby, and the Swedish explorer Nathorst. From 77° N. lat. and farther north the country, however, was practically unexplored, though the Duke of Orleans, on the *Belgica*, in 1905, had gone as far as 78½° N. lat., and from his ship had seen part of the outer islands.

The north-west had chiefly been explored by British and American expeditions, and the chief merit of the *Danmark* Expedition is that it has now supplemented what was still wanting in a knowledge of the outlines of Greenland by exploring the whole of the north-east coast.

The expedition consisted of twenty-eight members, and a characteristic feature of its organisation was the unusually large scientific staff and proportionately small crew, in the proper sense of the word. Thus there were six